ASTRONOMICAL SOCIETY OF LONDON.

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THE following communications were read: —

I. Observations and remarks made on a passage from New South Wales to England, by Charles Rumker, Esq., Member of the Society.

1st. A short table, with directions for ascertaining the time approximately by the position of the constellation of the Cross. For a rough estimation, it may be remembered that the Cross is vertical above the pole at midnight 21st March, and vertical below the pole at midnight Sept. 23rd.

2nd. Observations of the variation and dip of the needle, made on the passage home in 1829, round Cape Horn: and,

Observations of the variation and dip, made on the passage outwards by Sir Thomas Brisbane and Mr. Rumker, in 1821, round the Cape of Good Hope.

In these observations, which are very numerous, the date, latitude and longitude, the altitude of the sun when his azimuth was observed and his magnetic azimuth, the variation deduced, the place of the compass and the ship's course, are given. Mr. R. remarks, "that amongst observations made at sea which are of a permanent value, those of the variation and dip of the needle occupy the first rank, whether with respect to their use for navigation, or establishment of magnetic laws. Indeed, I think the method of ascertaining the longitude by a variation chart has been too readily abandoned. It should be remembered, that the object to be found, viz. the longitude, is, at the same time, the principal element for the construction of the chart, and was at that time ill known, being collected from the log-books of ships, which, owing to the then more precarious means of ascertaining it, were much out in their reckoning. The annual change in the variation was also not determined. I must allow that there are tracks where this method becomes impracticable, where the magnetic meridians run parallel with the equator; but over the whole of the Atlantic, as well as in the torrid zone of the Pacific, they are parallel to the terrestrial meridian, so that the change in the variation is as rapid as the longitude, and nothing can be imagined more convenient than to take the longitude from the ground we cross.

"The principal objection that can be started is undoubtedly the effect produced in the variation by changing the place of the

compass in the vessel, or by an alteration in the course. But this effect is less in proportion to the size of the vessel, and less in small merchantmen than in men-of-war carrying ordnance and ammunition; and it is these smaller vessels which, less likely to be provided with chronometers, will have occasion for the method. Besides, when an evil is once known, the remedy cannot be far off; and it is in high latitudes, where the dip is great, that the compass is much acted upon by surrounding objects: not so in the equator, where the magnetic force is concentrated in the horizontal plane.

"I may remark, that the great circle through Port Jackson and Cape Horn passes within 17° of the Pole; and although ships cannot approach it so near on account of the ice, it would shorten the distance to run down, at first, upon a S.S.E. course to latitude 58°, at which they must arrive to double the Cape. We saw no ice, and the lowest stand of the thermometer was 43°: we had constantly fresh westerly winds, which prevail here, with thick foggy weather."

3rd. Currents.

"The waters of the Pacific being supposed higher than those of the Atlantic, I expected an easterly current on approaching Cape Horn, but I could discover none. Near the northern coast of the Brazils and Guiana we experienced strong currents to the west, in conformity with Humboldt's theory of an indraft into the Caribbean Sea, occasioned by an equatorial current." Mr. R. gives a table of comparison between the ship's place by observation and that obtained by the log, with the drift and force of the current for twenty-four hours.

Mr. R. had no opportunity of making any geographical observations, except verifying the situation of Rat Island, as observed by Sir T. Brisbane and himself in 1821. He had reason to believe that the longitude of Fernando de Norunha is 32° 16′ W., as determined by Sir Thomas and himself, rather than 32° 35′, as stated in the charts. He would direct the attention of hydrographers to the errors in the position of the Brazilian coast, to which, perhaps, the currents have given rise.

"The greatest advantage which a chronometer affords is that of rendering permanent the use of lunar observations, (which would otherwise be as transient as the ship's place,) by deducing from every set simply the error from the *mean* time at Greenwich corresponding to the *true* distance, without any regard to the temporary longitude of the ship. These observations can be made at any time of the day, whether the sun rises slow or fast. Assuming, then, the mean of the errors found on several days as the error corresponding to the mean day, you obtain, twice a month, epochs for the errors of the chronometer, with its rate during the interval, which will enable you at any time to find your longitude *apparently* by chronometer, but, in *reality*, by the mean of numerous lunar observations."

" Thus I found—

1829.		Chron. fast on mean Greenwich time.			Daily Rate.
		h	m	s	s
January	12·0	1	25	43,2	15,0
	26·0	1	30	3,0	14,5
February	10·0	1	33	41,0	17,7
	27·8	1	38	56,5	14,6
March	11·5	1	41	47,5	13,9
	26·8	1	45	19,7	15,5
May	7·7	1	56	3,2	14,3
June	9·7	2	3	55,7	

" A gaining rate of 5ˢ had been given to this chronometer by the watchmaker who had charge of it at Sydney. Could its being kept on shore and on board make so much difference in the rate ?"

" The remaining uncertainties of the tables of Jupiter, Venus, Mars, and Saturn, are really inconsiderable in comparison with the degree of accuracy required for nautical purposes; whereas it is the light and distinctness of the object observed that steadies the hand of the observer, and enables him to keep it in the field of the telescope during the violent motion of the vessel, which is the greater the smaller the vessel, and, consequently, the less the probability of its being provided with a chronometer. The observations of the distances from fixed stars have, in a rough sea, difficulties which disappear in observations of the planets, which may, in strong currents near land, be the means of saving the lives of the crew."

4th. " *Sargasso Weeds.*—In the north Atlantic ocean, coming from the south, you fall in about the tropic with the Sargasso weeds, collected in narrow lines extending in the direction in which the trade wind blows, that is, E.N.E. and W.S.W., and the eye cannot see the end of them on either side of the vessel. These lines run constantly parallel to each other, and the nearer you come to the middle of the Sargasso Sea the thicker it is strewed with weeds, and the closer the lines approach to one another, being in some places but fifteen feet asunder. Homebound ships have a better opportunity of observing these lines, as they cross them nearly at right angles, and can trace their continuation more conveniently on both sides, observing one line after another in rapid succession.

" These weeds occupy the zone from about 20° to 35° north latitude, which may, however, differ according to the longitude in which you cross it. Towards the zone's northern extreme the weeds are less regularly formed in lines, which may arise from their being less methodically acted upon by the trade-winds that seem to occasion their order. They have been termed gulf-weeds by sailors, who believed them to be driven out of the gulf by the

Florida stream; nor is this opinion entirely refuted by the experience that they are rarely met with in the gulf. For the weed swimming on the surface of the Atlantic is withered, decayed, and incrusted with salt, which proves the time it has been exposed to the sun, and is of a brownish-yellow colour, whilst you rarely meet with a green bunch: that, being heavier on account of its higher state of vegetation, swims several feet below the surface. It is true that not with certainty can any roots, thicker branches, or stems, be perceived, wherewith they might have adhered to rocks or the ground: nevertheless, as these weeds abound with animals that do not live upon the surface but inhabit the bottom of the sea, such as crabs, shrimps, barnacles, conchilias of all descriptions, and serpents, I have no doubt but that they originated in a shallow basin of water, out of which they were swept by the force of a current along the bottom, until the heavier vegetable fluid being exhausted, they rose to the surface. Moreover, they are never seen near the European or African coast, but most plentifully found about the entrance of the gulf."

II. A letter from F. Hartmann, lieutenant of engineers, to J. F. W. Herschel, Esq., describing an instrument constructed for him, according to his own directions, by M. Hohnbaum, optician, of Hanover.

It is not very easy to understand the plan of this instrument without a drawing, but it would seem that Lieut. H.'s theodolite consists of a transit telescope resting upon two pillars sufficiently high to allow of the free revolution of the telescope; the whole placed upon a circle which moves freely in azimuth, furnished with a repeating apparatus. A divided circle is attached to each end of the transit axis, one of which has a vernier apparatus similar to that of the large Reichenbach meridian circles, the other serves to balance the former, and to set the telescope to any zenith distance required. It will be seen that, by this combination of azimuthal and vertical motion, Lieut. H. is enabled to *repeat* as with the circle of Borda.

The weight of the circle, &c. is eased by friction-rollers: the object-glass and eye-pieces are by Fraunhofer, and of great excellence, and the vertical and azimuth circles are about sixteen inches in diameter.

III. On the rectification and use of the equatorial. By M. Kreil.

This paper is intended to serve as a continuation and practical application of one by Professor Littrow on the same subject, published in the *Ast. Soc. Memoirs*, vol. ii. p. 45.

In Professor Littrow's memoir only four errors were considered; the displacement of the pole of the instrument in *altitude* and in *azimuth*, and the errors of the verniers of the declination and of the hour circle. The Professor conceives that the artist has secured the other important conditions, viz. that the axis of the telescope and the polar axis shall both be in the plane, or parallel to the

plane of the declination circle. In Reichenbach's large equatorials this circle is fixed so as not to admit of reversion, or (as it would seem) of the application of a level to the pivots of its axis; and the first part of M. Kreil's memoir is employed in ascertaining the amount of any derangement in this part of the instrument by *observation* alone.

The first of these errors (which is similar to the error of collimation in a transit) causes the star to be observed in a small circle parallel to the plane of the declination circle, and thus accelerates or retards the true passage of the star by a quantity varying as the secant of declination. The sign of this error would evidently be altered by reversing the declination circle upon its Ys, or, what is the same thing, by making the polar axis and the declination circle each perform half a revolution. The practical rule is, to observe the transit of a *star near the equator* over the middle wire of the telescope, noting both the *time* and the *reading of the hour circle*: Turn the polar axis and the declination circle each through 180°, and observe the star in the same way as before: Then, if the time elapsed between the two observations be equal to the difference of the two readings upon the hour circle, there is no error of collimation; but if these quantities be not equal, then half the difference between them, multiplied by the cosine of the star's declination, will give the error of collimation for a star in the equator.

The second of these errors (which is similar to that of inclination in the transit) causes the star to be observed in a great circle, which intersects the declination circle at the equator, and is most distant from it at the pole. The effect of this error upon the star's transit varies as the tangent of declination, and changes its sign with a half revolution of the polar axis. Hence, if the transit of a *star near the pole* be observed, exactly as in the foregoing case, (this observation must be corrected for the error of collimation previously determined), half the difference between the time elapsed during the two observations and the advance of the instrument upon the horary circle, will be the error due to the inclination of the declination circle.

M. Kreil then shews how the remaining errors of the instrument may be determined. The error of the declination verniers is readily found by observing a star (not too near the pole) in *declination*, before and after reversing the instrument as above directed; half the difference between the first and second readings being the error of the verniers. In all these cases, the star should be near the meridian, to avoid the effect of refraction.*

M. Kreil then gives examples drawn from actual observations made with a new equatorial added last year to the Vienna observa-

* The error of the polar axis in altitude may easily be discovered by meridian observations in declination of a star near the pole above and below the pole, allowing for the difference of refraction; the error in azimuth, by observing a polar star at 6^h and 18^h from the meridian. *The declination circle must not be reversed for these observations.*

tory. The circles are 2·1 feet in diameter, and the telescope has a focal length of 2·6 feet, with an aperture of 2·4 inches.

IV. On Barlow's new telescopes. By Professor Littrow.

It has long been a desideratum in practical optics to discover a means of shortening the focal length of refracting telescopes without reducing their aperture or injuring their distinctness. This can only be hoped for, in general, if we can increase the refractive or diminish the dispersive power of the crown-glass lens, or, on the other hand, diminish the refractive or increase the dispersive power of the flint-glass lens, which form the achromatic object-glass. The fluid lens of Mr. Barlow fulfils one of these conditions, for, with a refractive power not greater than that of the best flint-glass, it appears to have a dispersive power more than double, and thus enables us to diminish the focal length very considerably.

Professor Littrow gives the formula for a direct approximate solution of the curvatures to be given to the lenses when they are considerably separated from each other. The method is similar to that employed by Euler in his *Optics*, and requires, for the kind of lenses proposed by Mr. Barlow, an extension of the tables to be found in that celebrated work (these are given by Professor Littrow). This direct approximate solution is followed by an indirect accurate solution, similar to that already published by the author in the *Mem. Ast. Soc.*, vol. iii. p. 248, modified by the condition of the separation of the lenses, which enables us to reduce very much the size of the second lens.

Professor Littrow gives several examples of telescopes with large apertures and small focal lengths, and shews in each case that the *spherical* aberration is destroyed, as well as the *chromatic*.

V. A letter by Mr. Hubert to the President, suggesting the possibility that the discrepancies observed in pendulum experiments may arise from the effect of magnetic attraction. He recommends the pendulum to be swung, at the same place, in the magnetic meridian, and at right angles to it, in order to ascertain the fact; and that observers should be careful to swing the pendulum in the magnetic meridian for comparative observations.

VI. On Mayer's celebrated Catalogue of Zodiacal Stars, by Francis Baily, Esq.

Since the publication of the *Astronomical Observations* of Mayer, by the late Board of Longitude, Mr. Baily has examined the position of every star, by comparing each of them not only with the observations, but also with the catalogues of Bradley and Piazzi, by which means he has been enabled to detect many inaccuracies in Mayer's catalogue, which have hitherto puzzled the practical astronomer; and he has now given us a corrected catalogue, together with references to every observation of every star, in a collateral column, as well as the difference between the results of Mayer's observations and those of Bradley, his contemporary, in

another collateral column. The corrections which Mr. Baily has actually introduced are those only which are sanctioned by the observations themselves: at the same time, he has pointed out other corrections, which, although only conjectural, are highly probable; but these are kept distinct from the former. The author has subjoined a list of some other stars observed by Mayer, but not contained in his catalogue, as well as a list of several occultations. From the result of Mr. Baily's investigations, it appears that there is a very near accordance between Bradley and Mayer in the *declination* of the stars; and it is a remarkable fact, that the differences are almost always on the same side: the mean of all the comparison is 4″,27, which is the quantity by which Bradley's north polar distances exceed those of Mayer. There is a greater discordancy, as might be expected, in the *right ascensions*.

VII. A paper from Dr. Robinson, of Armagh, containing the results of his observations of Venus, for the purpose of determining thereby the mass of the Moon, in the way proposed by Professor Airy.

VIII. Two Memoirs by Don José Joachim de Ferrer, containing Observations made at the Havannah, from 1808 to 1812, with the resulting longitude and latitude of that city.

After a description of his instruments (which consisted of a $4\frac{1}{2}$-feet telescope and a reflecting circle, both by Troughton, and an excellent chronometer by Arnold,) M. de Ferrer proceeds to state the manner in which his observations were conducted.

For latitude, he employed circum-meridian observations of the sun at the solstices, of Capella, and of Rigel, taking an equal number with the instrument direct and inverted, and reversing the roof of the artificial horizon after every observation. In no case does a set of observations appear to differ more than 4″ or 5″ from the mean of the whole. The latitude of the observatory of the Havannah is 23° 8′ 17″,5 N., and that of the great tower of the Moro 23° 9′ 26″,2.

For longitude, the author employed the occultations of fixed stars and planets behind the moon. He did not conceive that, in any case, there could be an error of more than 1^s, either in the state of his chronometer, or in the observation itself. The places at which the star entered and quitted the moon's limb were previously computed. The magnifying power used was 180.

As very few corresponding observations could be obtained, M. de Ferrer formed a catalogue of the occulted stars in longitude and latitude for 1756, from the observations of Bradley, Lacaille, and Mayer, and another for the beginning of the century, from those of Maskelyne, Piazzi, De Zach, and Lalande; and, from a comparison of these, determined the annual variation of each star, and its place at the time of observation. The longitude and latitude of the moon was computed by him *directly* from Burkhardt's Tables, and the error of the Tables determined by a comparison with meridian observations, or with occultations of known stars, at Greenwich, Paris, Gotha, &c. The mean of 20 results gives the longitude of

the Havannah west of Paris $5^h\ 38^m\ 47^s,7$, no observation differing 10^s from the mean. The great tower of the Moro is $1^s,6$ west of the observatory.

There are, besides some eclipses of the sun and moon, and of Jupiter's satellites, the bearings and situations of points in the Havannah and in the island of Cuba.

"It will be seen, that, by these observations, I have deduced two values of the *Moon's inflexion;* the first by the time observed between the bisection of the star's disc and the instantaneous disappearance, and the second by the *duration* of the occultation, compared with the *calculated* semidiameter: I find the mean semidiameter to be used for reducing altitudes or meridian observations $= 15'\ 34'',27$; for eclipses and occultations, $15'\ 32'',34$.

The two values of the moon's semidiameter may thus be obtained, independently of micrometrical observations. Although the greater part of astronomers have noticed the extraordinary phenomenon of seeing the star between the observer and the moon, no one that I know of has thought of deducing from it the true inflexion. The semidiameter, as determined by micrometer, will be about $3'',8$ greater than that deduced from occultations."

All the necessary details, both of the instruments, observations, and calculations, are given with great distinctness, and leave nothing to be desired either for accuracy or clearness.

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